Learning from disasters: Saxony fights the floods of the river Elbe 1784-1845

Poliwoda, Guido

Historical Social Research, Vol. 32 — 2007 — No. 3, 169-199

Learning from Disasters: Saxony Fights the Floods of the River Elbe 1784-1845

Guido Poliwoda [*]

Abstract: *»Sozio-ökonomische Bewältigungsstrategien aufgrund wiederkehrender Hochwasserkatastrophen in Sachsen 1784-1845«*. After the millennium flood of 2002 in Saxony the subject of "climate change causes natural disasters" does not come to rest in the media and science. This article investigates how a society reacts, when it is almost constantly struck by natural disasters. Between 1784 and 1845 at least 12 disastrous floods happened in Saxony. The result thereof was a Saxon learning-genesis which is demonstrated in three learning phases (1784-1800, 1800-1820 and 1820-1845). Introductory explanations of historical aspects of and publications about natural disasters and high water research to day are provided. A theoretical framework on how to learn from natural disasters is attached. In the outlook, the Saxon learning genesis is compared to the study of the DKKV (Deutsches Komitee für Katastrophenvorsorge), "Lessons Learned" from 2003. Thereby not only analogies between previous and today's disaster management are drawn but also are underlined the more efficient methods and approaches of more than 200 years ago.

Introduction

Disasters are in great demand. The latest part of the IPCC report, published at the beginning of the year 2007, provided further momentum to the subject of "climate change causing natural disasters." The following examination is designed neither to underline nor to contest this assumption, but instead to focus on which historical aspects of today's management discussion can be considered useful, if, whether or when disasters are frequent or recurrent.

[*] Address all communications to: Guido Poliwoda, Institute of History, Dept. of Economic-Social- and Environmental History, Erlachstr. 9a, 3012 Berne, Switzerland; e-mail: guido.poliwoda@hist.unibe.ch.

Even today, research in climate and natural disasters has not truly extended its scientific character to accept the perceptions of social sciences. If one peruses the numerous publications in this field, the one thing that stands out is the imbalance between science and social science literature. Historical articles provide comparatively rare exceptions in this discourse. Furthermore, the historical study of natural disasters lacks comparative thinking and approaches, through which comprehensive assertions could be made. However, one can see that gaps have been narrowed and loopholes diminished by diverse studies carried out since the 1990s not only in Switzerland (MÜLLER 2004), but also in France (FAVIER/ GRANET-ABISSET 1999), England (MASSARD-GUILBAUD/ PLATT/ SCHOTT 2002), Germany (POLIWODA 2007; JAKUBOWSKI-TIESSEN 1992), Austria (ROHR 2004) and Spain (RODRIGUEZ 2003).

One must also point out that until recently historical studies of natural disasters have been capable only of delivering pieces of the mosaic depicting historical opinion. Historical high water research is also but a mere piece of this jigsaw puzzle and the examination shall therefore attempt to present a selection of articles dealing mainly with high water research in Saxony. Furthermore, this paper shall initially present a draft theoretical framework through which one can learn from natural disasters. Therefore it is necessary to examine the terms learning step, learning process and learning evolution. Following this I shall outline the pertinent assumptions drawn from the sections on "learning from disasters." I shall also ask whether warnings concerning global warming could have been provided with historical answers as a result of the Saxon learning evolution between 1784 and 1845. The main body of the examination provides an overview of the climate history between 1784 and 1845, enabling a presentation of the high water's recurrent momentum, which evoked considerable reaction from a wide range of commercial players and levels. The decisive question posed by this paper will be: How does political power react, when society is repeatedly affected by natural disasters?

Status of research

Climate research and historical climatology prepared the field for the commercial questions, which have been creeping into the foreground since the 1990s (PFISTER 1999). These aspects have been mainly investigated on the basis of case studies (BORST 1981, p. 529-569; MILITZER 1998). Historical catastrophe research (PFISTER 2002) is in the early stages of development and there is thus a requirement for studies on a whole range of levels. In the most recent papers which examine natural disasters in general, as well as those investigating the "Elbe flood" specifically, the authors criticise the fact that these sub-

jects have been examined either in a purely scientific, or in a primarily social context only (WEICHSELGARTNER 2003, p. 245).

Historical high water research

As already said in the introduction, this chapter will present ground-breaking studies in historical high water research. The study "Flood response and Crisis Management in Western Europe" by Rosenthal and t'Hart (1998) concentrates on disaster management of high waters in France during 1993 and 1995, the Netherlands, Belgium and West Germany. References are also made to other European countries such as Norway and England. The internal structure of each chapter is conspicuous, with each one running in the sequence "before – during – after" the disaster, something which is sadly missing in many studies.

Denis Coeur (2003a) has written an important study regarding the recurrent momentum of high waters. He extracted three marked high water periods during the seventeenth, eighteenth and nineteenth century for the rivers Drac and Isère. These periods of crises did not follow immediately one after another, although they did provide the French central administration with the opportunity to act offensively in each case: Canal construction in the seventeenth century, financing of dike construction after 1768 and a law on the protection of towns against high waters in 1858.

Since the mid-eighteenth century the local authorities in Grenoble led an improved management both prior to and during disasters. After 1778 they drafted a catastrophe plan, which served the same aims. Coeur's comments on the learning process as a result of this coping mechanism are relatively brief, although he does say of Grenoble that: "several times during the city history the fight against flooding has aroused many debates, underlying that this question was at the heart of its territories production process" (2003b, p. 378). In her examination of high waters from 1834, Agnes Nienhaus (2000) was able to demonstrate a catalytic function for the social modernisation process. Francisco Jorge Rodriguez (2003) shows in his study of the Segura from the seventeenth to the nineteenth century that the "terrible river" could be domesticated. Like Nienhaus, he too demonstrates the modernisation process which arose from the recurrence of floods.

In addition to these studies, Coeur (2003a; 2003b) and Rohr (2003) in particular have written papers which, together with Pfister's anthology "Am Tag danach" (2002), contributed to discussions about the term "disaster culture." These papers all describe the diverse reactions exhibited over the passage of time by communities as a result of recurring disasters, which more or less pulled these communities through. Is the extent and timing of a Saxon-based evolution of learning recognisable during the repeated high water disasters? This will be assessed later in the study, thus providing a further little piece in the mosaic of "historical natural disaster research".

Historical high water research on Saxony

In his comprehensive study, Stefan Militzer (1998) looks at high water disasters between 1784 and 1799 in detail. One should remain critical of Militzer's opinion that due to the fast recurrence of high waters in 1784/85 the state measures and private initiatives for disaster management had an ever-diminishing effect. In his writings he stresses that one can detect a redirection from reactive to preventative measures (IBID.).

Mathias Deutsch (2000) emphasises that state precautionary measures were implemented by the end of 1798. He includes the preparation of military units for ice-breaking and the implementation of an acoustic warning system with signal canons, which had been in work since 1784 (IBID., p.7-44; WEICHSELGARTNER 2003, p. 245-248; POLIWODA 2007). Backwaters resulting from ice on the Elbe occasionally led to extreme high waters which, together with ice-jams and burst dikes, led to extensive damage along the river. He looks at the measures instantly implemented on site (e.g. in Meißen) although he does not compare these with those from 1784.

Dieter Fügner (2002) examines a much larger timeframe. He looked through the records of Saxon high waters from 590 onwards (The Spangenbergs Mansfelder Chronik) right through to summer 2002. His judgements on the social/political reactions and actions are accordingly brief in each case and he mainly deals with the historical event itself. Like Deutsch and Militzer, he too looks at the historical climate-related background before touching on the individual disasters themselves. His details on the distribution and regularity of Elbe high waters are extremely reliable and very important in climatic-historical terms. This applies in particular to the climate information, which he extracted from sources in Pötzsch and which is limited to the period from 1500 to 1800 (FÜGNER 1987, p. 155-158).

In 1848 Wilhelm Schäfer wrote his "Chronik der Dresdner Elbbrücke" in which he examines the damage to the Augustus bridge in Dresden as a result of each high water. He provides an historical Elbe level indicator and river marker, which he derived from the bridge office archive (SCHÄFER 1848). With the high waters recurring between 1784 and 1845 it was interesting to examine the verifiable development on various social levels. To this end the sequences depicted by Militzer, Deutsch and Fügner were brought together, and further reactions and evidence of successful learning were consequently questioned (POLIWODA 2007).

Learning from disasters: Terms

In order to show when, why and who learns from high water, two 'definitions' must be introduced first. The question posed is whether and in what way learn-

ing is possible within a society, and what such learning comprises of. Furthermore, the extent to which history and the term learning process can be connected with one another has to be examined. Dealing with the question "learning from disasters" requires the distinction between specific terms. This distinction differentiates between the ideas of learning steps, the learning process and learning development or learning evolution.

Learning can be defined as the skill in correcting available action templates, creating new templates and making adjustments in order to reflect changing circumstances. The terms "learning" and "learning process" are therefore often associated with a stringent definition. This view is put into perspective when one assigns the idea of the learning process to wider contexts (KNOEPFEL/ KISSLING-NÄF/ MAREK 1997, p. 274). Diverse and randomly connected factors may be required to initiate learning processes on the basis of singular and non-repeatable historical developments. However, both can be assumed in the case of an historical process: a certain degree of chance against a general essence of conformity as should be underlined by the learning in the Saxon community.

Klaus Eder (1985) utilised the phrase "history and learning processes" in a causal context. He thinks that "up to the end of the eighteenth century the movement in enlightenment could be characterised by the education of society from above, that culture was diffused from the top down" (IBID., p. 129, translated Poliwoda). He touches on a paradigm shift. In modern terms the communication flow described is completely reversed. "Carriers of collective learning processes are now groups, which define themselves through the allowance of principally everyone to participate in group life in an equal measure" (IBID., p. 129f, transl. Poliwoda). In this context Eder posits a socialisation theory. The new bearers of political power were no longer legitimised by birth but instead by function (IBID., p. 357f.).

Regarding the question of whether learning processes can be defined by an historical process, Eder takes a relative stance. "Learning processes are mechanisms of an evolutionary development process. Within it a historical action relation is created, in which a new, normative orientation is practised and selectively held on" (IBID., p. 477f., transl. Poliwoda). Thus learning processes are compartmentalised by their historical "was and is". Not just the singularity but more essentially the relativity of historical formulations can thereby be expandend to accommodate fundamental components.

Hansjörg Siegenthaler examined periods of social crises on the basis of economic cycles. He has been able to ascertain the existence of learning in regular confidence intervals as well as fundamental learning (SIEGENTHALER 1993). When referring to learning in regular confidence intervals, he points out the fact that improvements are made by using available templates during times of economic and political stability. In times of crisis however these templates are called into question and society is required to create new templates and rules.

This process he considers as fundamental learning. Crises therefore offer the option of abandoning the well-trodden pathways in order to discover new solutions.

Christian Pfister (2002) expanded upon Siegenthaler's theory. He was able to show that natural disasters could also result in fundamental learning processes. In "Am Tag danach" he emphasises that the effects of natural disasters require innovative procedures (IBID., p. 240f.). Further studies by a whole range of disciplines show that natural disasters have resulted in improvements in public and private institutions (PASCHE 2002; MASSARD-GUILBAUD/ PLATT/ SCHOTT 2002; SCHOTT 2003; COEUR 2003b, p. 373-378; MÜLLER 2004; POLIWODA 2007).

The assumption that individual natural disasters would result in social learning processes was contradicted by R. W. Kates (2000). He stresses that a momentum of repetition would be essential if learning processes were to be detected. Kates demonstrates this fundamental point on the basis of high water catastrophes: "Floods need to be experienced, not only in magnitude, but in frequency as well. Without repeated experiences, the process whereby managers evolve emergency measures of coping with floods does not take place" (IBID., p. 8). There one must differentiate between learning steps and learning processes. Learning steps will be initiated after individual disasters and occasionally after learning processes, too. A comprehensive cross-society learning development or evolution is likely after multiple events.

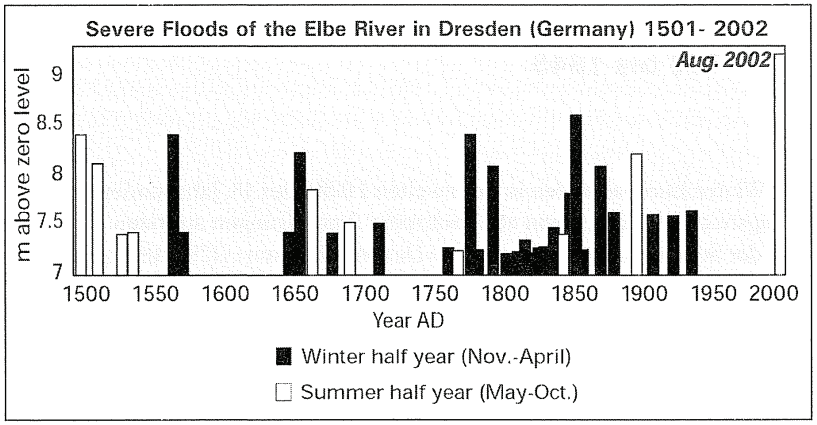
The majority of publications to this day, which examine the history of natural disasters look specifically at single incidents. These incidents feature learning processes, without looking at the extent to which other social factors have led to these processes or indeed influenced them. A distinction between learning steps, learning processes and learning evolutions avoids this form of amalgamation. This "three-way breakdown" also tackles amalgamation and also deals with time differentiations and players, time periods and effects. Direct, indirect, short-term and long-term learning successes are hereby all illustrated.

Denis Coeur (2003b) utilises the term "genesis" in the title of his publication "Genesis of a public policy for flood management in France" (IBID., p. 372). He thereby refers to the procedural measures implemented by the state and public as a result of high waters. The longer-term learning developments described by him with the word "genesis" are affected by single (short-term) learning steps and mid to longer-term learning processes. It is only in the context of these three different timeframes that one can speak of a "genesis" or a longer-term learning development/learning evolution. The term learning evolution shall be used hereafter to describe a longer-term, comprehensive and multi-layered social learning process.

The historical climate background between 1784 and 1845

The following timeframe functions as a basis for the entire examination. The regularity of winter floods between 1784 and 1845 can be considered as a clear climate signal (Dalton Minimum). One perceives importance not only in the period under examination, indeed the millennium flood of 2002 also emerges as a historical incident:

Fig. 1: Severe Floods of the river Elbe in Dresden, Germany, 1501-2002



Source: POLIWODA, Guido/ PFISTER, Christian: Documentary data and the millennium flood of 2002 (<http://www.pages.unibe.ch/shighlight/archive03/poliwoda.html>, accessed 22.11.2006).

If the average temperatures shift to extremes, meaning hot or cold weather, then these will become more prevalent in the affected area. If one examines the winter temperatures in central Europe from the second half of the eighteenth century until 1830 then this synopsis of the average temperatures returns a negative result. The temperature sequence in Berlin between the 1780s and 1790s lies at approximately 1.4 - 1.7 degrees Celsius below the Dahlem (district of Berlin) average (1909-1969). This shift in the average temperatures in Saxony gave rise to weather extremes in the form of cold waves (to below minus 30 degrees Celsius). The same relation for the period up to 1845 could be substantiated by an ample compendium comprising diverse sources from the German-speaking world (POLIWODA 2007, p.51-58). In combination with a sudden onset of warm air came a renewed recurrence of high water disasters (ice floods), because the frozen rivers suddenly broke free and the ice which

accompanied their flows frequently caused build-ups. It remains to be said that every flood should be examined in its own right. Every flood will demonstrate its own meteorological, hydrological and social pattern even if comparable meteorological characteristics preceded the start of high waters which led to the specific extreme incident (RUDOLF/ RAPP 2003, p. 186).

Counter-measures and learning steps in learning phase I: 1784 to 1799

Distinction is drawn between the terms learning steps, learning processes and learning evolution (long-term learning processes). Differentiation must also be made between the short-term learning steps and the mid-term learning processes. Here, the results of learning shall be presented in order to demonstrate what could be learned through the decades, how the phases build on one another and why the phrase learning evolution is justified for the period under examination.

Counter-measures

The ice flood of 1784 threw Saxony into chaos. Meter thick ice floes cut through the rivers, fragments destroyed houses; boats which had been cut loose and timbers stored on the riverbanks were swept away by the flood tides, cutting everything in their paths to tatters. Dams burst, mills, infrastructures and industries all along the river were destroyed, some villages sunk to their church spires under the icy floodwaters. Nine people died whilst the government in Dresden simply watched the events unfolding in paralysis. How did such a disaster come about?

The eye-witness and scientist Pötzsch reported in 1784 that the temperatures dropped immediately before the ice break-up, and no one was able to anticipate such a destructive ice flow. The last flood of this magnitude in Saxony took place in 1655, and the lack of efficient defences and rescue mechanisms before and during the disaster were understandable. In the decades before 1784 Saxony, unlike Austria, had not been confronted with disastrous high waters. Prior to 1784 rescue forces were able to put preventive defence strategies into operation, the lack of which would only become apparent in Saxony after the disaster had taken place.

The result of this traumatic incident was the immediate implementation of counter-measures such as the elimination of ice from the fields by the military. In the days that followed the flood, the ruling prince of Saxony, Friedrich August III, sent money to the affected areas for distribution by local officials to those individuals affected by the disaster. In acute emergency situations, such

as those in 1784 and 1799 the monarch personally visited the emergency regions. Friedrich August III arranged this visit for the very first time as a symbolic act, wishing to demonstrate the compassion of a nation to his suffering people.

Fig. 2: Preventive hygiene regulations

Zu Abwendung epidemiſcher Krankheiten und zu Erhaltung der Geſundheit derer hieſigen Einwohner, erfordert es die unumgängliche Nothwendigkeit, daß in denen Gaſſen und Orten, welche bey der heurigen abermahligen Ueberſchwemmung in Waſſer geſtanden, ebenfalls nachfolgende auf höchſte und hohe Anordnung, bereits unterm 7. Mart. des vergangenen Jahres, durch den Druck bekannt gemachte Vorſchriften und Maasregeln allenthalben, auf das genaueſte, beobachtet werden; Und zwar

1) ſind die Gebäude, Gehöffte, Keller, Scheunen und Ställe, von dem zurückgebliebenen und ſtehenden Waſſer ſchleunigſt zu reinigen, und iſt ſolches auszuſchöpfen und abzuleiten; hiernächſt ſind

2) ſämtliche, beſonders die zur Wohnung beſtimmte Behältniſſe und durch die Waſſerfluth verdorbene Quartiere von Schlamm und Unrath zu räumen, die Fußböden und Wände ſorgfältig abzukratzen, die Oefen zu heitzen und, wenn die Wohnungen heiß ſind, alle Fenſter und Thüren aufzumachen, auch vorzüglich darauf zu ſehen, daß friſche Luft in ſolche gebracht werde; So lange

3) dieſe Austrocknung dauert, haben die Einwohner täglich zu drey- vier- und mehrmahln mit Wachholder-Reißig, Wachholder-Beeren, Wein-Eßig-Rauch, oder auch, wenn die gehörige Vorſicht dabey beobachtet wird, mit Schieß-Pulver zu räuchern, und

4) dieſe Wohnungen nicht eher, als bis alles trocken und von denen Gerichten beſichtiget, auch für tüchtig und wohnbar befunden worden, zu beziehen, ſowohln,

5) zu Beförderung der Geſundheit, fleißig Waſſer mit Wein-Eßig zu trinken, und laue Fußbäder zu gebrauchen. Nächſtdem

6) iſt unumgänglich nothwendig, daß ſämtliche Brunnen und Röhrwaſſer, auf denen überſchwemmt geweſenen Gegenden, öfters und rein ausgeplumpet und Küchen-Saltz eingeſtreuet werde.

7) Sollen die Soldaten, nach dem von der Behörde zu erhaltenden hohen Befehl, die überſchwemmt geweſenen Quartiere nicht eher als nach zwey bis drey Wochen beziehen. Dreßden, den 26. April 1785.

(L. S.) Der Rath zu Dreßden.

Source: DRESDEN, Stadtarchiv: RA CXVIII 72, 26.4.1785.

In order to ensure that economic process did not grind to a complete halt, the streets and customs offices were put back into operation as quickly as possible. Direct financial assistance was given to those industries and manufacturing branches which were seen as being essential by the state, including for example

the textile and porcelain industries. Further immediate counter-measures were set on preventative hygiene regulations. Local officials were issued with rescripts, which they had to publish and implement in their immediate communities.

In 1799 the Dresden council advised officials that they had to instruct state and public health officers to monitor health within affected areas. The handbook of hygiene regulations was published time and again throughout the period under examination nearly without changes to its content. The next step towards overcoming disasters have been the construction measures implemented in the destroyed towns and villages. In 1784 the state contributed almost 50 per cent of the money required for restoration. No subsequent disaster was met with such financial commitment from the state. Private contributions were mostly encouraged through state initiatives and supported relative distribution across affected administrative bodies. In addition citizens with elevated social status placed appeals for funds in the newspaper of Leipzig. The essence of these appeals was that those inhabitants coming from the areas where the appeals originated, would also be those who were those most heavily affected.

With contributions made only by the private sector it was possible to determine a considerable reduction of about 40 per cent from 1784 to 1799. Although the damage caused by the flood in 1799 was greater than in 1784, not only state contributions but also private support measures (called up by the state) were reduced by around 20 per cent. In addition to the large-scale disasters in 1784, 1785 and 1799, state and private support also assisted the citizens through the worst of the floods in 1792 and 1795. The ceaseless high waters resulted in a requirement for permanent financial support, which can be seen as the reason for this increasingly restrained commitment.

The state was responsible for providing finance for the maintenance of dams and dikes on the navigable rivers. Increased spending was necessary here after 1784 and thus the state attempted to relieve itself of this responsibility in some districts. In 1781 a law was drafted which would include new maintenance obligations for the river controls. In 1787, 1793 and 1799 the state parliament demonstrated that the ruling elector and the finance committee had in principle agreed on the spirit of the new decree: the rising costs for the maintenance and construction of river controls should from now on be borne by those who would gain from the direct use of them. The privileged classes and in particular neighbours of the Elbe would be required to make greater contributions in the future.

The route towards consolidating the provision of Saxon state finance following the seven-year struggle should not be endangered by the recurrence of high waters. This is where the struggle transcended into a longer-term learning process. Before the new law was introduced it was acknowledged that the permanent costs for maintaining the river controls could not be wholly deposited with the communities themselves. They would have to be given new financial op-

tions. There was a risk that an over-burdening of the communities could lead to the state being forced to finance an escalating loss-making business.

Learning steps

In order to be better prepared for the recurrence of ice floods the top administrative level began to react preventatively from 1785 onwards. Administration workers were instructed often in warning citizens in good time and initiating preventative de-icing procedures. An increased preparation, vigilance and passing on of instructions centrally from Dresden were now expected of local officials.

Scientists and laymen discussed possible preventative measures in magazines and newspapers. The general consensus was that the Elbe riverbed should be freed of sandbanks, sand ridges, tree trunks etc., so that the ice would flow along the river more easily. Scientific commentators recommended a bridge construction, which could not be destroyed by subsequent ice floods.

In 1804 general river regulations were discussed at the local administration. It was determined that corrective measures should be developed in the future. This shows that prior to 1800, regulations of the broadest kind were already applied to which the form of discussion described would have made a definitive contribution. Likewise sources demonstrate measures planned for 1785, which would utilise the coming floodwater to remove sandbanks and ridges. However, this innovative thinking came to nothing due to excessive de-icing by the Elbe ships in the area around the Augustus Bridge in Dresden.

Open to public discussion was the question whether it would be advisable for the military to detonate ice barriers, either by using artillery fire or through the application of incendiary devices. Such attempts were made not only in 1784 but also in the 1770s, whereby they were seldom successful. If the ice moved at all then this was usually uncontrolled and led to damage to the infrastructure. The learning step was made by putting the various applied defence strategies into perspective. Critical opinions dominated discussions and sources report little of such exploding commandos in the nineteenth century.

Before a possible ice break-up the elector ordered the clearing of the so-called “trails”, boarded routes across the ice. Those points where the trails were laid out were areas of thickly frozen ice, which would become ice barriers once the ice began to break down. These barriers would hold back the water and submerge entire strips of land.

In order to avoid the pending disaster of a forthcoming flood, timber merchants were required, through the issuance of many rescripts, to remove their logs from the banks of the Elbe. The disaster of 1784 saw the floodwaters lift meter-long logs and sweep them away, causing excessive damage in particular to wooden bridges.

It is possible to ascertain further learning steps in the February of 1785. An acoustic warning system consisting of cannons was installed along the banks of the Elbe, intended to sound a timely warning to the communities in the event of an ice break-up; there was also a rider relay system installed to support it. Work on the acoustic system had been underway since the previous year although various writings from the nineteenth century suggest that the acoustic warnings rarely fulfilled their purpose. In 1820 water construction director Wagner spoke of the system as never being efficient. In Prussian Torgau the system was abandoned for good in the 1830s – for the same reasons.

Boats for rescuing and evacuating individuals threatened by the water were also put in place. In 1799 the elector combined emergency relief and hygiene measures. Support of affected communities required interaction between officials and doctors, a system that would enable optimisation immediately after high waters.

By 1800 local preventative measures had been considerably improved. As soon as water rose to the upper Elbe those towns situated on the river would send inspectors to the dikes. A dike attendant would organise a 24-hour inspection of the dike. Thus, an initial basis for implementing defensive measures due to predicted severe high waters was now in place, something, which was unprecedented in German-speaking regions in this form. It is important also to note that the recurring momentum of high waters prior to 1800 did not only define financial limitations, but also vitally revealed potentials which would clearly be significant in the future if such disasters were to recur. The actual regime reacted in various ways to natural disasters. The state officials applied the options available to them in an increasingly routined manner. Available routes were extended and new ones were created. The officials adapted to the disaster by doing everything in their power to avoid chaos like that in 1784.

The focal implementation of essential measures and prevention concepts was configured by the top administrative level until the turn of the century – the head of which was the Secret Finance Committee, the later Finance Ministry, which was solely responsible for providing compensation payments, formulating reconstruction measures and improving the infrastructure. Until 1800 the institutions considered themselves essentially to play a defensive role. Individual instructions and the flow of communication were delivered from above – from Dresden to the local officials on the periphery. The local level was held in the "absolutist grip" of the rescript instructions from Dresden. The extent to which this resulted in the innovative "dike-side" watches following the turn of the century can be assessed in the comments emanating from various local officials, who criticised in particular the complex arrangement of bureaucracy left over from the Middle Ages. They complained that this led to an inability to clearly categorise the skills of officials, resulting for example in bank reinforcements varying on the basis of an individual's discretion alone. Effects of the recurring momentum were seen particularly in financial efforts.

The commitment of the state and that of private contributors dropped alarmingly and never succeeded in regaining the noteworthy sums of 1784.

Counter-measures and learning steps in learning phase II: 1800 to 1820

Counter-measures

Although until 1804 the floods did not reach truly catastrophic dimensions, this did not alter the strain on the state. Financial burdens resulting from high water damage were reported by local and higher officials, and these were mostly borne by the state. A construction project intended to repair and improve the dams in the so-called "Ostragehege" area of Dresden (1803, 1807-1809), can be taken as an example of the permanent nature of problems at hand. The Augustus bridge in Dresden suffered damage between 1801 and 1803, which is detailed in the bridge office archive from 1848, contained in Schäfer´s compendium. The dams and dikes throughout the electorate of Saxony were in such an appalling condition that comparable costs were incurred across every dike, a fact that was highly conspicuous given the financial problems related to bank defences and river controls in Graditz and Werdau in 1810/11.

The format for financial compensation following the flood in 1804 was similar to that seen in the previous year. The private and state template remained in place. The same applied to the maintenance of dams and dikes. The costs continued to be assigned to those areas which were to gain protection from the river defences. The de-icing of the Elbe in Dresden in 1805 had also been taken from the catalogue of measures utilised in the eighteenth century.

The military received preventative instruction from the secret cabinet prior to the flood in 1809. The formulation "as otherwise done in similar cases"[1], does not clearly indicate whether these measures refer to the floods in 1801 to 1803, or to the period preceding this. It could be that, due to the severity of the floods in the 1780s and 1790s, this offensive application of the military (preventative instruction of the troops, option to command the local authorities in the event of flooding, every form of risk defence, assistance and rescue to those affected by the high water, distribution of units to those areas where the military was not already stationed etc.) should in fact be assigned to the first coping and learning phase.

[1] DRESDEN, Hauptstaatsarchiv: Loc. 5788: Acta die der bevorstehenden Eisfarth halber dem Militari ertheilte Anweisung betr. 1809, 1810, 1811. p.1a.: „wie in gleichen Fällen sonst geschehen" (above transl. Poliwoda).

In January 1809 the King demanded "mutual communication"[2] of the Dresden city council, and the police were deployed to the city with the task of improving communications. The preventative measures and the exchange between the top and local levels of administration were becoming increasingly interactive in the period between 1804 and 1810.

Learning steps

In 1804 Saxony was hit by a summer flood. In contrast to the ice floods, which preceded it, the local authorities ensured that the banks were cleared of logs in good time (24 to 72 hours before the flood tides). Data acquired in 1785 was now utilised. The timbers had once been surrendered to the swirling chaos of the ice floods in the eighteenth century, but now all efforts were thrown into removing the logs from the water. Whilst in other areas the previous assumption had been made that a 24-hour period would offer a sufficient margin of safety, in Pirna the officials had undercut this value. The area had suffered damage as a result of logs caught up in the floodwaters. This event enabled a subsequent calculation of the time taken for the floodwaters to reach affected locations. Corrective measures on the river itself were further implemented. Prior to 1800 ideas regarding river controls had been purely nature-driven. However, from 1804 onward the best possible measures were introduced on the basis of the specific characteristics of the river affected.

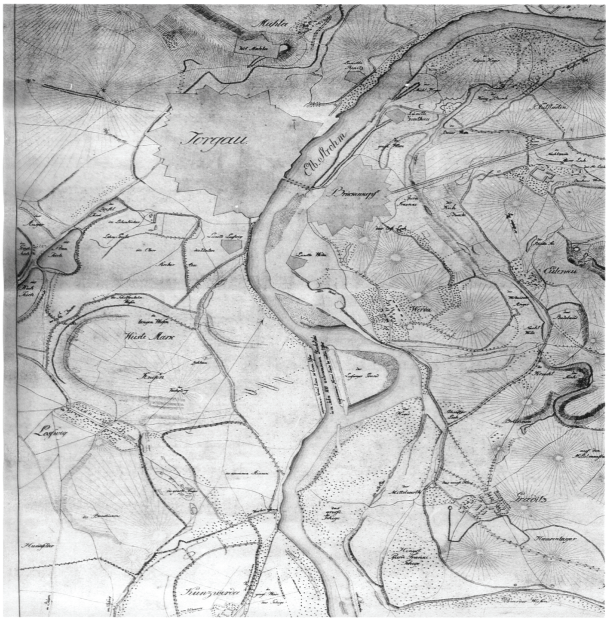
Financial considerations came markedly to the fore from 1810. For the period from 1771 to 1810 the Secret Finance Committee lamented maintenance costs for the dam sections in Graditz and Werdau (approximately three kilometres of river) totalling 70,000 Thaler. This would not be a financial option in the future. An extrapolation of this figure would have given great cause for concern, even if one were to assume that not every stretch of the river could incur such extensive costs. The entire Saxon stretch of the Elbe would have added costs in the range of ten million Thaler to the Saxon budget! If one adjusts the possible maximum value to between four and five million Thaler as a portion of the Saxon budget then one clearly comprehends the speedy, non-bureaucratic, top-level management involved in the reduction of these costs. Initially it was planned that 31,000 Thaler would be provided for a tunnel through the Loswig Bush, so that dam breaks in Graditz and Werdau would not result in entire swathes of land being submerged under water.

However, even this comparatively small sum caused difficulties. The amount was finally achieved via a mixed finance package in which tax exemptions were agreed for those inhabitants in Graditz and Werdau who would stand to gain from the use of the river control measures. The recurring formulation,

[2] DRESDEN, Stadtarchiv: RA CXVIII 76b: Acta, Die beym harten Winter, p. 97, 98: „wechselseitige Kommunikation" (above transl. Poliwoda).

that the citizens would be held accountable for contributions [Quelle?] shows the viewpoint from which the fight against the Elbe floods was fought[3]. The top administrative level preventatively tackled the flooding of the Elbe not so much from a humanitarian as from an economical/political viewpoint. As stretched as the financial situation was in 1810, it is clear that the privileged classes eased the plight of the inhabitants of Belgern and Riesa following the flood in 1811. High water damage, which destroyed their properties for the third time, was met with contributions from precious funds.

Fig. 3: Cutting through the Elbe meanders at Torgau



Source: BERLIN, Geheimes Staatsarchiv: E 52.485

The knowledge that the permanent costs had to be reduced and that those individuals behind the dikes could not be left alone to procure the requisite finance resulted in the idea of creating a dedicated fund. This form of fund would comprise of an annual contribution of 5,000 Thaler from the privileged classes, which matched with an identical contribution by the state. The payments would be made irrespective of whether river defences, tunnels etc. were constructed or not. This would result in an accumulation of monies.

[3] DRESDEN, Hauptstaatsarchiv: Loc. 6539: Acta, Die Unterstützung der Grundbesitzer, P. 17 b, 18 a.

The Elbe flow, bank and dam decree in 1819 saw the king and officials create a law, which was intended to regulate every aspect affecting the Elbe. The fundamental essence of the decree was the intensified financial contribution of the Elbe neighbours in riverbank defences and dams. In addition to new financial regulations, from now on a dam administrator would organise arrangements before, during and after high waters. The forms of organisation in place at the end of the eighteenth century had been extended and improved. From now on all districts neighbouring the Elbe were required to place dam monitors on the dams in the event of rising river levels. A mobilisation of all available powers was regulated by paragraph five.

Prevention, measures and in particular financial systems had gained entirely new foundations by 1820. Structures had been created, which were intended to enable a systematic fight against problems and crises such as the spread of chaos and a financial overburdening of the state and its inhabitants. The second learning phase had been catalysed by the strained financial situation of the state budget and the calculations of the Secret Finance Committee, regarding the dike sections in Graditz and Werdau.

From 1820 the administrative department of Saxony commanded that the police take up ice monitoring positions on the Elbe dams three days before an ice break-up. During their patrols, the police corresponded with the neighbouring Elbe districts, and were required to report all changes in the water level, the ice flow and any damage to the dikes to the administrative department by horseback messengers. The police officials were also required not only to man the signal cannon and prepare the dikes, but also to instruct the people and inform them of the appropriate reactions to the cannon soundings. With the Elbe level rising, the forces began gathering at the affected locations around the dikes and dams. The dramatic defence measures surrounding the flood of 1820 demonstrated the efficient ad hoc reactions of the local authorities. Likewise the administrative department of Saxony reacted in advance, prepared for the event that the dikes would not hold and entire swathes of land would be submerged. Communication and assistance to areas cut off by flooding was guaranteed from 1820 onwards.

The second phase culminated with the Elbe flow, bank and dam decree in 1819. The Elbe neighbours did not entirely adhere to the law banning them from building their own dams, but an orientation a landmark was now in place and water construction director Wagner knew to build upon this with his 35-page report issued one year later. Wagner drew up this report following the flood in 1820, based in part on the experiences of local officials. The fact that warning signals were not issued from cannons in the manner detailed in literature from the eighteenth century can be taken from Wagner's report as well as other writings.

Statements made by Wagner and the Secret Finance Advisor von Zeschau, a member of the Financial Committee in Dresden, regarding improvements of

the disaster defences were becoming increasingly military. The weakness of individual dam defences, the private contributions made to them and the fact that disaster defences had still not run in an optimum manner could all be excuses for these military expressions. This tone also crept latently into annual announcements from 1826 – seen as comprehensive preventative measures – published across the state.

In his report from 1820, Wagner delivered an "ideal." The expert listed everything that would be necessary. Even though only a certain section of this list was to be implemented in the 1820s, important elements were adjusted, in particular using the Elbe flow, bank and dam decree, upon which one could subsequently build. The districts lying on the Elbe were combined to create dam communes in order to address the maintenance of the dams using a wider support mechanism. The Finance Committee set up dam funds into which the dam communes were required to pay an annual contribution, irrespective of whether defences were constructed or not. This was the final handing-over of the state's obligations to the river defences from the government to the Elbe communities.

The bank defence commission selected a dam administrator from the dam communes, responsible for ensuring that the rescue team was alerted, material for dam security was made available and messages were sent to the neighbouring districts. The new decree meant that the neighbouring districts were now also legally responsible for defence against disaster. It was not possible to create any judicial conformity in the period immediately after 1819. The continued general construction of individual dams restricted further learning processes, which would have been important in the stringent progression of regulation work on the Elbe.

With regard to institutions, both Torgau (which was forcibly ceded to Prussia after the Vienna Congress) and Dresden had a water construction directorate in 1811, which was subordinate to the Secret Finance Committee. The water construction director was in charge of the technical officials and water construction department, in which the borough leaders of administration were represented. This guaranteed that the three levels involved all dealt with district business as a "network". This resulted in the suggestions from the administrative department following the flood in 1820. They felt themselves compelled to cooperate more actively in the process, as they were more strongly connected with it. One such suggestion was the creation of raised areas and emergency stoves so that bottlenecks could not prevent the administering of aid following high waters.

The learning steps in the first phase were transferred into a learning process. Learning in terms of prevention, measures and the forms of previous coping strategies had been built upon. Clear improvements, particularly in prevention in both ad hoc and sustainable areas (finance / Elbe flow, bank and dam decree) had been achieved. In addition to these not insignificant steps, it is also appar-

ent that there was an acceptance that damage assessment and health care measures were associated with one another. This acceptance enabled the state officials to get a more efficient and faster assessment of the situation and thereby organizing an improved reaction in extreme circumstances.

Institutional improvements were implemented in the run up to the new decree. From 1811 water construction directorates in Torgau and Dresden worked with experts to investigate the high water issue in detail. In addition, water construction directors and local officials in the administration worked together with the districts. The costs of increased control of the rivers were transferred to the users. Funds, dam funds and the regulations of the new law created entirely new instruments with which to carry the permanent (not only financial) excessive strains.

Learning steps in learning phase III: 1820 to 1845

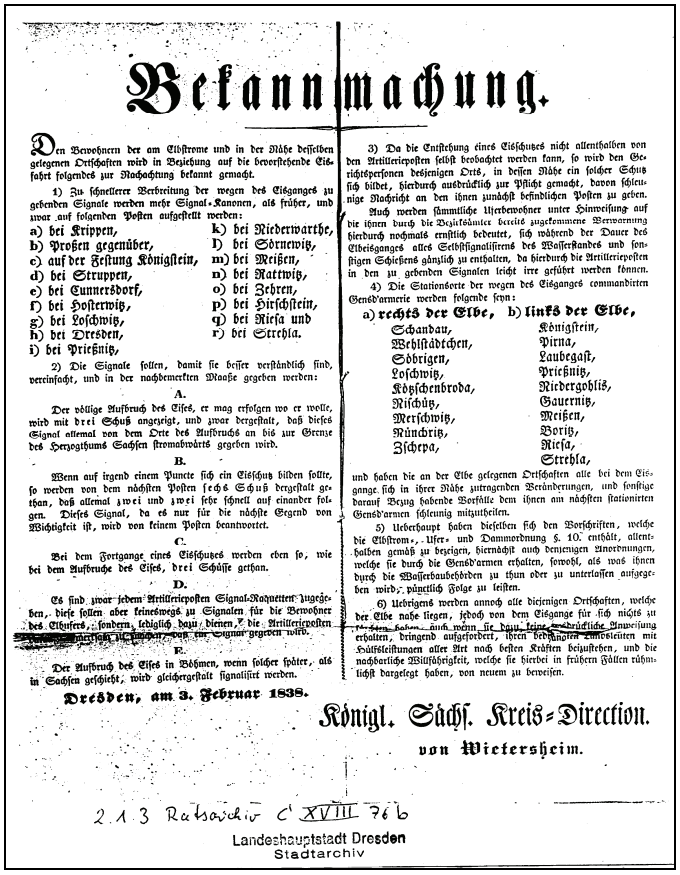
From 1826 an announcement was issued before every ice flood, containing the most important of Wagner's principles, which were detailed in the learning steps from the last decade. The number of signal cannons and the police posts along the Elbe were increased. The actions of the inhabitants along the Elbe were governed by an optimised catalogue, which precisely instructed them pre, during and post disaster.

The region of Torgau, Prussian from 1815, had also begun to accept announcements in preparation for disaster defence. The two publications were similar not only in content but also in terms of their military style. The learning input collated for the Wagner report came to a great extent from the local officials. They were the ones who witnessed the requirements for improvement at local level during an ice flood.

The state-wide announcements, published from 1826, channelled the previous learning steps into a comprehensive specification of actions for implementation before, during and after high water. The learning development which enabled this considerable improvement in the mechanisms of coping with disaster must be attributed to the lower administrative levels. It was from here that the learning pulses were emitted, which influenced an overall disaster management up to 1845. Wagner integrated the recommendations of local officials into his report to the finance committee. The announcement of 1826 included a large number of these recommendations, such as the optimising of signal shots and the inclusion of the Elbe flow, bank and dam decree.

This optimised the behaviour of the inhabitants living on the Elbe before, during and after a high water disaster. This third phase should become the decisive one. The learning steps in phases one and two were integrated into the measure catalogue so that it is possible to speak of a form of disaster management. With his report, Wagner delivered a matrix, which then simply required implementing.

Fig. 4: Public announcement



Bekanntmachung.

Den Bewohnern der am Elbstrome und in der Nähe desselben gelegenen Ortschaften wird in Beziehung auf die bevorstehende Eisfahrt folgendes zur Nachachtung bekannt gemacht.

1) Zu schnellerer Verbreitung der wegen des Eisganges zu gebenden Signale werden mehr Signal-Kanonen, als früher, und zwar auf folgenden Posten aufgestellt werden:

a) bei Krippen,
b) Proßen gegenüber,
c) auf der Festung Königstein,
d) bei Struppen,
e) bei Cunnersdorf,
f) bei Hosterwitz,
g) bei Loschwitz,
h) bei Dresden,
i) bei Priesnitz,
k) bei Niederwarthe,
l) bei Sörnewitz,
m) bei Meißen,
n) bei Rattwitz,
o) bei Zehren,
p) bei Hirschstein,
q) bei Riesa und
r) bei Strehla.

2) Die Signale sollen, damit sie besser verständlich sind, vereinfacht, und in der nachbemerkten Maaße gegeben werden:

A.

Der völlige Aufbruch des Eises, er mag erfolgen wo er wolle, wird mit drei Schuß angezeigt, und zwar dergestalt, daß dieses Signal allemal von dem Orte des Aufbruchs an bis zur Grenze des Herzogthums Sachsen stromabwärts gegeben wird.

B.

Wenn auf irgend einem Puncte sich ein Eisschutz bilden sollte, so werden von dem nächsten Posten sechs Schuß dergestalt gethan, daß allemal zwei und zwei sehr schnell auf einander folgen. Dieses Signal, da es nur für die nächste Gegend von Wichtigkeit ist, wird von keinem Posten beantwortet.

C.

Bei dem Fortgange eines Eisschutzes werden eben so, wie bei dem Aufbruche des Eises, drei Schüsse gethan.

D.

Es sind zwar jedem Artilleriepostenen Signal-Raqueten zugegeben, diese sollen aber keineswegs zu Signalen für die Bewohner des Elbufers, sondern lediglich dazu dienen, die Artilleriepostenen [illegible] von [illegible] gegeben wird.

E.

Der Aufbruch des Eises in Böhmen, wenn solcher später, als in Sachsen geschieht, wird gleichergestalt signalisirt werden.

3) Da die Entstehung eines Eisschutzes nicht allenthalben von den Artilleriepostenen selbst beobachtet werden kann, so wird den Gerichtspersonen desjenigen Orts, in dessen Nähe ein solcher Schutz sich bildet, hierdurch ausdrücklich zur Pflicht gemacht, davon schleunige Nachricht an den ihnen zunächst befindlichen Posten zu geben.

Auch werden sämmtliche Uferbewohner unter Hinweisung auf die ihnen durch die Bezirksämter bereits zugekommene Verwarnung hierdurch nochmals ernstlich bedeutet, sich während der Dauer des Eisganges alles Selbstsignalisirens des Wasserstandes und sonstigen Schießens gänzlich zu enthalten, da hierdurch die Artilleriepostenen in den zu gebenden Signalen leicht irre geführt werden können.

4) Die Stationsorte der wegen des Eisganges commandirten Gensd'armerie werden folgende seyn:

a) **rechts der Elbe,**

Schandau,
Wehlstädtchen,
Söhrigen,
Loschwitz,
Kötzschenbroda,
Nischütz,
Merschwitz,
Nünchritz,
Zschepa,

b) **links der Elbe,**

Königstein,
Pirna,
Laubegast,
Priesnitz,
Niedergohlis,
Gauernitz,
Meißen,
Boritz,
Riesa,
Strehla,

und haben die an der Elbe gelegenen Ortschaften alle bei dem Eisgange sich in ihrer Nähe zutragenden Veränderungen, und sonstige darauf Bezug habende Vorfälle dem ihnen am nächsten stationirten Gensd'armen schleunig mitzutheilen.

5) Ueberhaupt haben dieselben sich den Vorschriften, welche die Elbstrom-, Ufer- und Dammordnung §. 10. enthält, allenthalben gemäß zu bezeigen, hiernächst auch denjenigen Anordnungen, welche sie durch die Gensd'armen erhalten, sowohl, als was ihnen durch die Wasserbaubehörden zu thun oder zu unterlassen aufgegeben wird, pünctlich Folge zu leisten.

6) Uebrigens werden annoch alle diejenigen Ortschaften, welche der Elbe nahe liegen, jedoch von dem Eisgange für sich nichts zu befürchten haben, auch wenn sie dazu keine ausdrückliche Anweisung erhalten, dringend aufgefordert, ihren benachbarten Landsleuten mit Hülfsleistungen aller Art nach besten Kräften beizustehen, und die nachbarliche Willfährigkeit, welche sie hierbei in frühern Fällen rühmlichst dargelegt haben, von neuem zu beweisen.

Dresden, am 3. Februar 1838.

Königl. Sächs. Kreis-Direction.

von Wietersheim.

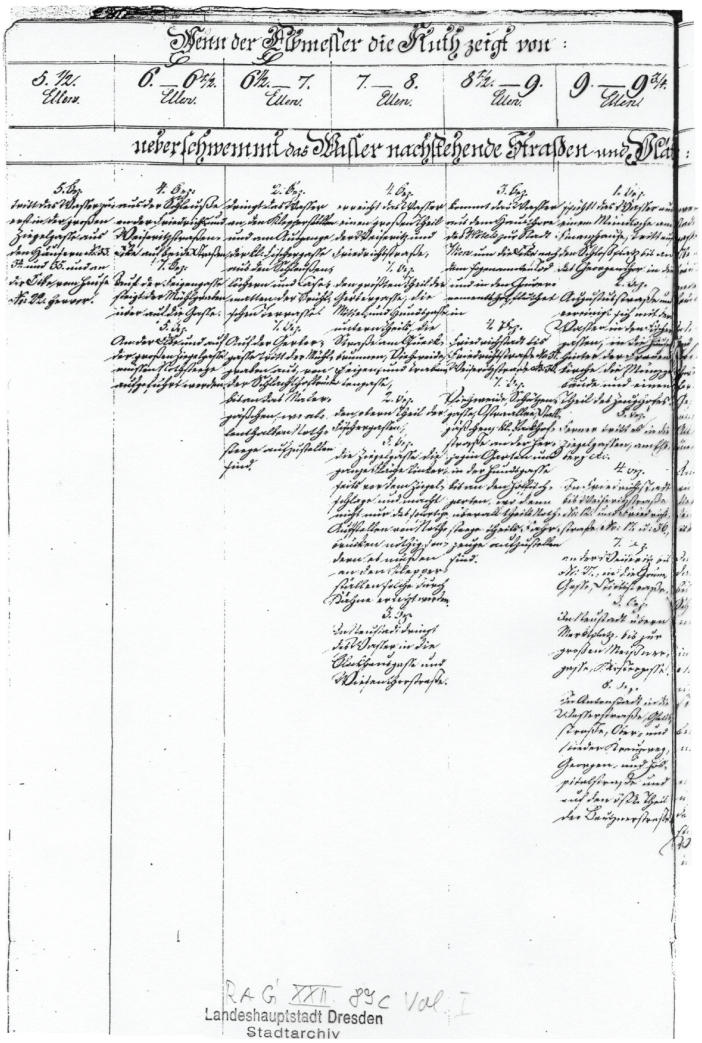
Source: DRESDEN, Stadtarchiv: RA CXVIII 76b.

In 1835 the people of Dresden founded a rescue association. The aim of the association was not only to save peoples' lives during high waters, but also to save the belongings of those directly affected by the ice floods. From 1836 it had become possible in Dresden to estimate what levels of the Elbe would flood which areas of the city. A "risk card" was developed using the experiences of non-destructive floods from the previous decades. This enabled a preventative and more efficient use of emergency services.

Between 1838 and 1840 the administrative departments continued to provide further recommendations on how to improve disaster management. The fact that there was extensive compliance with this adopted form of precaution-

ary announcement is reflected in an outstanding phase of coping, in which the Saxon communities worked to prepare themselves and achieved a level of fully acceptable disaster management in 1845.

Fig. 5: High water chart



Source: DRESDEN, Stadtarchiv: RA GXXII 89c Vol. I.

Communication between the cannon stations, the police and the main town did not fall apart in 1845. During the flood, police and local officials continued to send messages to the borough offices in Dresden, where defence coordination was taking place. This guaranteed reactions to the changes in the ice flows and water levels and ensured that defence measures would be optimised accordingly during high waters.

Officials in the city applied newly obtained knowledge together with information gained through many decades of experience. Military, material and police forces were positioned at critical points in the city at the right times, so that work was carried out with due thought and consideration as the Elbe rose. Everything possible was done for the people. The inhabitants of Dresden praised the organisation even during the disaster: "Everywhere and with increasing danger there was order, peace and trust in the insight of the truly fatherly authorities."[4].

Although the consequences of the flood in 1845 were more successfully overcome than those of previous floods, the borough administrator Marbach and the imperial ministry summoned a crisis management committee. This crisis management committee comprised of the interior minister or his representative, a member of the war office, the borough administrator, the mayor and the police chief for Dresden, and the head of the first administrative department. They were required to meet before any future flood, to centrally advise and agree on the necessary measures.

Summarised characteristics of the learning evolution

The entire Saxon community applied itself directly or indirectly to the issue of high waters. If the structure of the state is examined then one sees a vertical penetration across the complete timeframe. This vertical penetration manifests itself through a range of coping mechanisms such as cash contributions, disaster defences, health care etc., or the continued implementation of measures such as de-icing the areas preceding the bridges using the millers or fishermen, or with the Elbe ships.

It is possible to discern constant and reflexive learning by the time measures were combined to create one step (health care was integrated into emergency aid in 1799), and one can ascertain this learning characteristic over the complete period under examination. A vertical ability to react, which was implemented immediately after 1784 (whereby laymen were also publishing improvement recommendations) was not only a central but also a consistent theme which ran right through to the flood of 1845.

[4] „Überall war bei steigender Gefahr, Ordnung, Ruhe und Vertrauen auf die Einsicht der wahrhaft väterlichen Behörde."; DRESDEN, Stadtarchiv: RA GXXIV 75; transl. Poliwoda.

The Saxon state budget was existentially threatened by the recurring high waters. Local measures could not prevent waters breaking through the dikes and the monetary support from the districts and communes became disproportionate when compared to the state. At the end of the eighteenth century the monarchy financed an extensive proportion of the damage costs, but in the nineteenth century the state finally relinquished this responsibility and left the costs of damage to be met by those affected. Disagreements over finance, as witnessed in Ihleburg, Graditz, Werdau and Canitz, showed that the "new officials" pursued the reformed financial system at the lowest level. A smoothing out of the hierarchy was underway. The bottom, middle and top administrative levels were all involved in this process. The introduction presented Eder's socialisation theory regarding history and learning processes, a theory which was substantiated in the transition from the eighteenth to the nineteenth century; he also described a levelling of the hierarchies and new officials (EDER 1985, p. 357f.).

Financial coping was supported by a broader base. Towns and districts were henceforth required to fund preventative and additional costs. This system reform can be evaluated as a mark of the start of the socialist society.

The attitude towards disasters changed from 1800. High waters were no longer considered as plagues. The local officials attempted to avert catastrophic results preventatively at the dikes. This was developed by officials in situ. They provided the water construction director Wagner with their experience and advice and he went on to present this to the Secret Finance Committee. At the beginning of the new century this process reversed the flow of disaster defence information. Thus the year 1800 can be seen as a turning point both in terms of coping mechanisms as well as the resulting learning steps. Until the turn of the century the local officials were required to follow the instructions and rescripts issued by Dresden. In the first decades of the new century, their recommendations were being included in the disaster catalogue, and from 1826 this became a form of announcement distributed across the state.

Until the formulation of a constitution (1831) Saxony's administration was dominated by the restorative policies of the Cabinet Minister von Einsiedel, supported by the king. The existing contradictions between the ruling policies and the increasing strength of society were clearly apparent. Other characteristics can also be attached to the disaster management: the reversal of the flow of information from bottom to top resulted in disaster management being increasingly transferred into the hands of civilians. The result was a socialisation, which vertically permeated higher levels of administration.

The officials optimised the disaster defences before, during and after the incident (people, materials). This took place with a "hardened coping" (military tone of the announcements, legal implications upon refusal, application of the military and trained forces).

With this ‘mobilisation’ the players in mid-level administration enforced a networked disaster communication across all layers. They implemented their ideas in orders and decrees. Officials, the administration, the military, districts and communes communicated and organised high water prevention, defences and follow-up measures together from the 1820s onwards – as a network. Hierarchies (for the attainment of improved defences) were levelled by this new form of communication. From 1826 one can speak of a sectorally-networked disaster management, in which the players worked together. After 1820 and the Wagner report, the reflexive learning elements gained in strength (those demanded by Schanze as a result of the 2002 flood), not only because the information flow had transferred from bottom to top, but also because all contributory levels were interacting with one another. From the 1820s one can discern that “self-supporting, cooperative learning processes for a lasting coevolution with territory specific high water risks” were aimed at; this was achieved by “continuous and reflexive learning” (SCHANZE 2002, p. 253, transl. Poliwoda).]

Until 1800 it was essentially the officials and nobility in Dresden that organised and determined defence measures. After 1800 these key functions were transferred to the local officials who could now act with greater impulse – in particular from the second half of the 1820s. The continuous improvement in disaster management resulted from the learning steps and learning processes of local officials.

Following the disaster in 1845, Saxony had access to a state-wide announcement which preceded the onset of high waters, a risk card for Dresden and a crisis management committee, together providing it with a modern disaster management system. In six decades (of which two were intensively utilised) the Saxon administration had learned not only how to cope with the disastrous ice floods, but how to preventatively defend itself against them. The Saxon learning evolution, in particular in the period between 1820 and 1845, represents an astonishing portrayal of the demands of Schanze in 2002, after which improved high water risk measures gave rise to a change from high water protection to high water risk management. Planned intervention in order to reduce uncertainties was apparent in all phases of learning (MILLER 2002, p. 43).

If the question is raised whether this learning evolution evolved more from a trust in regulations/ routines or a fundamental/ intensified learning, then one encounters long statements such as those formulated by Siegenthaler (1993). He does not assume a recurring disaster momentum. He considers that individual crises offer the opportunity to put processes in place, which would otherwise not be made available to a society. In his opinion, the period prior to the turn of the century was such a time, and that the decades immediately thereafter were in fact the shock-free decades which accelerated the learning evolution – with greater force than the impacts of 1784 and 1799. In this respect, the learning gained with the hardship of each flood did not accumulate immediately,

even though the floods of 1820, 1830 and 1845 can be seen as amplifiers for the existence of the learning evolution. In all three learning phases both routine and intensified learning can be ascertained. Fundamental/intensified learning was increasingly transposed into learning based on trust in regulations/routines, although the resultant learning exhibits a fundamental character. High waters became normality, just as it was 'normal' to act against them in as systematically as possible – because the institutions assumed no later than 1827 that the floods were not about to cease occurring. The degree to which the results were fundamental can be deduced from the fact that the Prussians went also through a "phase of announcements" and advanced with comparable results and innovations.

A sober handling of disasters is a central theme, which runs through the entire period under examination. The ice floods were not suffered – they were survived. This basic strategy was prevalent in all three phases. Penal-theological interpretations could not be found. After the disaster in 1784 an increasing number of sermons were held, although these did not follow a uniform pattern but merely promoted recurrent ideas of solidarity.

The state was required to reduce the short-term and long-term costs and had begun to successively transfer the burden of diverse costs to the beneficiaries of regulatory measures by 1819 at the latest. It attempted, insofar as possible, to eliminate the short-term costs through the implementation of an improved disaster management as shown with the announcements from 1826. The better the prevention and disaster management provided, the lower the costs incurred.

From 1781 work began on the Elbe flow, bank and dam decree. This was given legal form in 1819, and in the following year Wagner presented details of the actions of the inhabitants before, during and after the high waters to the highest level of administration. This innovation resulted from experiences of the ice flows on the dikes and in the districts, which had been gained by local officials, prior to, during and after the floods. This cumulative permanence, with which one could tackle subsequent floods, was the key to achieving a systemization phase, which was intended to cumulate in the 1830s and 1840s, and all of this promised a cost minimisation for the strained Saxon state budget. Additionally came the non-contribution of the state to direct flood victim aid. Only in 1784 did state and private restitution cover 50 per cent of the cost of damages. Thereafter, the state and/or private support never reached such high proportions again. In 1845 the state considered it adequate that private donations alone covered approximately 30 per cent (possibly a little more). In both the eighteenth and nineteenth century, the remaining damages were handed over by the state for private self-regulation. This may sound reductive, but financial aspects dominated events.

A long-term reduction in costs was to be achieved through non-contribution to costly dam construction. It was not without reason that this subject became a regular focus for disputes, respective denials of responsibility and the centre of

quarrels, in which various factions attempted to avoid the costs for de-icing, the provision of footbridges etc. These differences could not be attributed to specific administrative levels alone; indeed at times all those from the lord of the manor right through to the king were involved.

The learning evolution described peaked in an extensively enhanced management from 1845. This must surely be looked at in an additional time horizon as for example the year 1861, commonly referred to as the threshold in which far-reaching Elbe legislation was passed – which can be attributed to the catastrophic floods prior to 1845.

Technophobia, originally acquainted with high industrialisation, became associated with high waters from 1845. Doubts went round in newspapers, as to the extent to which previous river controls had in fact caused the 1845 high waters and revealed a modernist character. The fact that people experienced ambivalence towards the technical innovations which were increasingly dominating their lives, underlined the modern risks (ecological problems), which were arising from sustained intervention into the natural world.

In order to improve coping strategies with recurring ice floods the entire administrative apparatus would need to pull in one direction. The Secret Finance Committee and the subsequent Finance Ministry (from 1831), were particularly responsible for dictating the direction in which developments were to head, and to what extent and how quickly river controls, tunnels, compensation payments etc. could or should be implemented.

The innovations in the first decades of the nineteenth century resulted from ageing of the local administrative levels. Their ideas and recommendations resulted in innovations in local management, which were included in Wagner's report and in the announcements, which were made during the decades that followed. This can be related to Max Millers (2002) definition of a learning process: "A learning process and some outcomes of a learning process can only be attributed to a group of human beings if at least a majority of the individuals members constituting that group can be said to have performed that learning process" (IBID., p. 20). In the case of Saxony, the 'group' described by Miller comprises of both the local officials and the water construction directorate. They established the learning process. Through diligent work and improvement, the water construction director and the local officials initiated decisive learning pulses, which were emitted across the board, culminating in cumulative learning processes. These can be seen as system reforms, as a "process, in which a new social coordinate system […] and competence in handling the new circumstances could be achieved"[5].

The implemented learning evolution is remarkable and demonstrates how a society is able to cope successfully with a climate trend that has a negative

[5] „[...] Prozeß, in dem ein neues gesellschaftliches Koordinatensystem gleichzeitig geschaffen und die Kompetenz im Umgang mit den neuen Verhältnissen erworben werden konnte." HATER 1998, p. 19; transl. Poliwoda.

impact upon it. The modern treatment of ever-recurrent crises situations was accompanied by modern, self-fabricated risks. The control of the Elbe exhibited knock-on effects in 1845. Debate ensued after the flood, attempting to assess the extent to which habitations had been built on flood plains – the extent to which the control of the Elbe had actually strengthened the high waters that followed. Conversely, the Saxony administration learnt nothing from these modern deliberations – it would appear that the pressure, which had enabled the learning evolution in the previous years, was thereafter not yet sufficiently large for this degree of risk.

The outlook: The 1784-1845 learning evolution compared to the DKKV study "Lessons Learned" 2002

Under the patronage of Irmgard Schwaetzer and renowned scientists such as Uwe Grünewald, the DKKV (Deutsches Komitee für Katastrophenvorsorge; German Committee for Disaster Management) published a study in 2003, of which the title was "Hochwasservorsorge in Deutschland, Lernen aus der Katastrophe 2002 im Elbegebiet". ("High water prevention in Germany. Learning from the 2002 disaster in the Elbe region").

Fundamental to the thesis presented in this examination is the assumption that the deficits demonstrating [demonstrated] in the study as existing in today's disaster management were formerly equally [were equally] existent in the period under assessment (1784-1845), although these could be relatively efficiently remedied. This comparativeness is evident from the first chapter of the DKKV study. With regards to the high waters from 1997 on the Oder, and 2002 on the Elbe, the study states that: "Not only in those affected they unsettled the confidence in the security of their living conditions and in the reliability of for example political and institutional bodies responsible for the protection against high waters and underlined how much our highly technical and organised society is vulnerable to the extreme hazards of nature"[6].

The uncertainty of a large proportion of the population can be seen as having acted as a considerable momentum and trigger for the successful coping and clear learning effects of the floods between 1784 and 1845. As early as the period following the initial incident in 1784 it is evident that even laymen were publishing suggestions regarding defence against high waters. The differentiation voiced by Siegenthaler, in ascertaining that the time of uncertainty exhibited a greater learning effect (fundamental learning), aligns with this connex-

[6] „Sie erschütterten, nicht nur bei den direkt Betroffenen, das Vertrauen in die Sicherheit ihrer Lebensumstände sowie in die Zuverlässigkeit z. B. politisch und institutionell Verantwortlichen für den Schutz vor Hochwasser und verdeutlichten, in welch hohem Maße unsere hochtechnisierte und hochorganisierte Gesellschaft anfällig gegen extreme Naturgefahren ist."; DKKV 2003, p. 8, transl. Poliwoda.

ion. If one examines the end point of the learning evolution then the opposite of uncertainty can be seen[7].

This quote is confirmed by the weaknesses in disaster management in 2002 shown by Schanze. In 1845 the preceding, comprehensive learning steps and learning processes had culminated in a learning evolution, for which the population praised the authorities even in the face of the flood. The fundamental conclusions of the DKKV study show a failing in cooperation at both regional and central levels: "The present study shows that neither at prevention nor at coverage of high water disasters in Germany the necessary degree of cooperation, communication and management existed. Both lack sufficient collaboration between expertise, administration and regional borders, particularly beyond the borders of the federal states"[8].

Cooperation between the affected authorities in the period under examination began back in 1784 and continued to grow in strength right through to 1845, resulting in the formulated crisis management group, of which the representative of the Ministry for the Interior and the War Ministry were an inherent part. Cooperation (sometimes with identical instructions for the inhabitants) is documented for Saxony and Prussia, and also for Saxony and Bohemia.

Likewise the assertion that one must eliminate a lack of clarity regarding responsibilities, in order to achieve clearer affiliation of skills and instructions, can be directly aligned with the Saxon learning evolution. The aged organisation of administration at the end of the eighteenth century led to a comparable criticism from the local officials. From the introduction of the Elbe flow, bank and dam decree in 1819 the organisation was placed on structured foundations, which could be built upon in the decades which followed, and from 1845 the district director in Dresden coordinated the counter-measures across the entire state.

In the field of action provisions, the study demanded a checklist through which the necessary materials could be made available in the event of a disaster. In the eighteenth century the materials were positioned in central locations and the announcements from 1826 onwards instructed the inhabitants to have everything required for an emergency on hand.

After the flood in 2002 private households were surveyed in order to establish the extent to which those affected knew how to act with the instructions from the authorities. 40 to 50 per cent of those asked could not implement the regulations (DKKV 2003, p. 20). Up to the 1820s the population did not understand the meaning of the cannon signals. The announcements/action regulations

---

[7] See above note 4.

[8] „Die vorliegende Studie zeigt, dass weder bei der Vorsorge noch bei der Bewältigung von Hochwasserkatastrophen in Deutschland das erforderliche Maß an Kooperation, Kommunikation und Führung vorhanden ist. Bei beiden mangelt es an ausreichendem Zusammenwirken über Fach-, Verwaltungs- und Raumgrenzen, insbesondere über Bundesländergrenzen hinweg."; DKKV 2003, p. 11, transl. Poliwoda

published and distributed across the states from the 1820s optimised the behaviour of inhabitants before, during and after a high water incident.

Possibly the most focal point of the problem, finance, can also be compared in the past and current circumstances: "The time-consuming and financially demanding repair of the dikes must be complimented by consistent dike maintenance and preventive planning and control with consideration of the focal factor of disaster precautions"[9]. Analogies can be drawn to underline this quote right from 1781 through to the final phase of the learning evolution. The transition from state maintenance of the dikes to private contributions would be comparable today given a recurring momentum of disasters. Additionally, longer pre-warning periods were demanded, with the inhabitants receiving an initial warning by siren (DKKV 2003, p. 31). Both are measures, which were implemented following the first and second learning phases. The signal shots from 1785 and the storm bells which sounded once the dikes were unable to hold, reflect today's demands.

The same applies to the risk cards, which were intended to enable an estimation of anticipated water levels. From 1836 these risk cards were in use in Dresden where they assisted considerably in optimising disaster management in 1845. Modern risk cards were demanded in the new Saxon water legislation from the 1st September 2004 for communes at risk along the Elbe and which they have to produce in the future (REY 2004, p.7). The recommendations from local officials, incorporated into the ever-growing action regulations from 1820, are today required in the form of „Nachbereitung des Ereignisses" ("incident debriefings") (DKKV 2003, p. 32). A learning of individuals on the dike is an unavoidable element in improving arrangements before, during and after a high water disaster.

It is clear from the examination that one fundamental aspect requires reconsidering. In the chapter "Terms" I wrote of history and learning processes that: Diverse and randomly connected factors may be required to initiate learning processes on the basis of singular and non-repeatable historical developments. However, both can be assumed in the case of an historical process: a certain degree of chance against a general essence of conformity, as should be underlined by the learning in the Saxon community. This applies in equal measures to the learning processes, which followed the flood of 2002. The discussion should therefore include the question of whether and to what extent one can learn from history. This is not the place in which to discuss this apparently philosophical question in detail.

In final conclusion it is essential to comment one last time on the sectoral linking of individual action levels from 1826. Back then, today's "mangelnde

[9] „Die zeit- und finanzaufwändige Instandsetzung der Deiche ist durch konsequente Deichunterhaltung und vorsorgende Planungen und Bewirtschaftung unter Berücksichtigung der Gesichtspunkte der Katastrophenvorsorge zu ergänzen." ; DKKV 2003, p. 27, transl. Poliwoda.

Verbundenheit der korporativen Katastrophenschutzakteure" ("lacking connection between the cooperative disaster protection agents") (DKKV 2003, p. 10f., transl. Poliwoda) was the subject of considerable focus and effort on the part of the Saxon administration. The successes witnessed then could be repeated today, although the extent to which a recurring momentum is required for this is, and remains, an unknown quantity.

References

BERLIN, Geheimes Staatsarchiv Preußischer Kulturbesitz: E 52.485, Durchstich durch den Loswiger Busch 1811, 1:12.500.

BORST, Arno (1981): Das Erdbeben von 1348. Ein historischer Beitrag zur Katastrophenforschung, in: Historische Zeitschrift 233, p. 529-569.

COEUR, Denis (2003a): La maitrîse des inondiations dans la plaine de Grenoble (XVII-XX siècle). Enjeux techniques, politiques et urbains. Thèse de Doctorat. Sous la direction de Monsieur professeur René Favier. Université Pierre Mendès France. Institut d´Urbanisme de Grenoble, Grenoble.

COEUR, Denis (2003b): Genesis of a public policy for flood management in France: The case of the Grenoble valley (XVIIth-XIXth centuries), in: THORNDYCRAFT, Varyl R. et al. (ed.): Palaeofloods, Historical Data and Climatic Variability. Applications in Flood Risk Assessment, Madrid, p. 372-378.

DEUTSCH, Mathias (2000): Zum Hochwasser der Elbe und Saale Ende Februar/ Anfang März 1799, in: DEUTSCH, Mathias/ PÖRTGE, Karl Heinz/ TELTSCHER, Helmut (ed.): Beiträge zum Hochwasser/ Hochwasserschutz in Vergangenheit und Gegenwart, Erfurt (Erfurter geographische Studien, 9), p. 7-44.

DKKV/ DEUTSCHES KOMITEE FÜR KATASTROPHENVORSORGE e. V. (2003): Hochwasservorsorge in Deutschland. Lernen aus der Katastrophe 2002 im Elbegebiet, Kurzfassung der Studie Lessons Learned, Bonn (Schriftenreihe des DKKV, 29).

DOMBROWSKY, Wolf R. (2002): Flußhochwasser – ein Störfall der Vernunft? in: Gaia 11, p. 310f.

DRESDEN, Hauptstaatsarchiv: Loc. 5788, Acta Die bevorstehende Eisfarth halber dem Militari ertheilte Anweisung betr. 1809, 1810, 1811.

DRESDEN, Hauptstaatsarchiv: Film 2074, Der Eisgang der Elbe, vol. II 1838-1840.

DRESDEN, Stadtarchiv: RA CXVIII 72, Acta, die bey dem gefallenen großen Schnee und daher zu besorgenden großen Waßer allhier getroffene Vorkehrungen betr. Ergangen dem Rathe zu Dresden ao: 1785.

DRESDEN, Stadtarchiv: RA GXXIV 75, anonym: Darstellung des Eisgangs und der Wasserfluth des Elbstromes in den letzten Tagen des Märzmonats 1845.

DRESDEN, Stadtarchiv: RA CXVIII 76b, Acta, Die beym harten Winter und Ergießungen des Elbstrohms im Jahr 1799 allhier getroffenen Veranstaltungen betr. Ergangen beym Rathe zu Dresden 1798, 1799, 1809, 1811, 1820, 1823, 1827, 1830, 1838.

DRESDEN, Stadtarchiv: RA GXXII 89c Vol. I., Acta. Die große Ueberschwemmung im Monat März 1845., die daraus hervorgegangenen Calamitäten und dabei getoffenen polizeilichen Maaßregeln betreffend.
EDER, Klaus (1985): Geschichte als Lernprozess? Zur Pathogenese politischer Modernität in Deutschland, Frankfurt a. M.
FAVIER, René/ GRANET-ABISSET, Anne Marie (ed.) (1999): Histoire et Mémoire des Risques Naturels. Actes du Séminaire International "Histoire et Mémoire des Risque Naturels en Région de Montagne", Grenoble.
FÜGNER, Dieter (²2002): Hochwasserkatastrophen in Sachsen, Leipzig/ Zwickau.
FÜGNER, Dieter (1987): Historische Wetterbeobachtungen vor dem 19. Jahrhundert in Sachsen nach Christian Gottlieb Pötzsch, in: Sächsische Heimatblätter 33/1, p. 155-158.
HATER, Katrin: Gesellschaftliche Lernprozesse im politischen Diskurs. Eine Fallstudie zum Diskurs um das Braunkohlentagebauvorhaben Garzweiler II, Dissertation Technische Hochschule Aachen, Aachen 1998.
JAKUBOWSKI-TIESSEN, Manfred (1992): Sturmflut 1717. Die Bewältigung einer Naturkatastrophe in der Frühen Neuzeit, München.
KATES, R. W. (2000): Hazard, in: SLOVIC, Paul: The perception of risk, London, p. 7-11.
KNOEPFEL, Peter/ KISSLING-NÄF, Ingrid/ MAREK, Daniel (1997): Lernen in öffentlichen Politiken, Basel/ Frankfurt a.M.
MASSARD-GUILBAUD, Geneviève/ PLATT, Harold L./ SCHOTT, Dieter (ed.) (2002): Cities and Catastrophes. Coping with emergency in European history, Frankfurt a. M. et al.
MILLER, Max (2002): Some Theoretical Aspects of Systemic Learning, in: Sozialer Sinn 3, p. 1-58.
MILITZER, Stefan (1998): Kima-Umwelt-Mensch (1500-1800): Studien und Quellen zur Bedeutung von Klima und Witterung in der vorindustriellen Gesellschaft, Bd. 1., Leipzig.
MÜLLER, Reto (2004): Das wild gewordene Element. Gesellschaftliche Reaktionen auf die beiden Hochwasser im Schweizer Mittelland von 1852 und 1876, Nordhausen.
NIENHAUS, Agnes (2000): Naturkatastrophe und Modernisierungsprozess. Eine Analyse gesellschaftlicher Reaktionen auf das alpine Hochwasser von 1834 am Fallbeispiel Graubünden, Lizentiatsarbeit Historisches Institut der Universität Bern, Bern.
PASCHE, Léna (2002): Inondations de 1868 et émergence de la politique de correction des eaux et de reboisement dans les Alpes suisses au cours du XIX siècle. Le cas du Valais et de la région de Conthey, Lausanne.
PFISTER, Christian (1999): Wetternachhersage. 500 Jahre Klimavariationen und Naturkatastrophen (1496-1995), Bern.
PFISTER, Christian (2002) (ed.): Am Tag danach. Zur Bewältigung von Naturkatastrophen in der Schweiz 1500-2000, Bern.
POLIWODA, Guido (2007): Aus Katastrophen lernen. Sachsen im Kampf gegen die Fluten der Elbe 1784 bis 1845, Köln/ Weimar/ Wien.
POLIWODA, Guido/ PFISTER, Christian (2003): Documentary data and the millennium flood of 2002. (http://pages.unibe.ch/shighlight/archive03/poliwoda.html last accessed 22.11.2006).

REY, Lucienne (2004): Die Schweizer Hochwasserhilfe in Sachsen trägt Früchte, in: Neue Zürcher Zeitung, Samstag/Sonntag 28./29 August, No. 200, p. 7.
RODRIGUEZ, Francisco Jorge (2003): The Domestication of a Terrible River: The Model of the Segura River and the City of Murcia (XVIth-XIXth c.), Rivers in History: Designing and Conceiving Waterways in Europe and North America, Lecture delivered at the Conference of the German Historical Institute, Washington D. C., December 4-7.
ROHR, Christian (2004): Überschwemmungen an der Traun zwischen Alltag und Katastrophe. Die Welser Traunbrücke im Spiegel der Bruckamtsrechnungen des 15. und 16. Jahrhunderts, in: Jahrbuch des Musealvereins Wels 33, 2001-2003.
ROSENTHAL, Uriel/ T'HART, Paul (1998) (ed.): Flood Response and Crisis Management in Western Europe. A Comparative Analysis, Berlin et al.
RUDOLF, Bruno/ RAPP, Jörg (2003): Das Jahrhunderthochwasser der Elbe. Synoptische Wetterentwicklung und klimatologische Aspekte, in: Klimastatusbericht 2002, Deutscher Wetterdienst Offenbach, Offenbach, p. 172-187.
SCHÄFER, Wilhelm (1848): Chronik der Dresdner Elbbrücke, nebst den Annalen der größten Elbfluthen von der frühesten bis auf die neueste Zeit. Aus den vorhandenen Quellen, namentlich den Acten des Brückamtsarchivs geschöpft und bearbeitet von Dr. Wilhelm Schäfer, Dresden.
SCHANZE, Jochen (2002): Nach der Elbeflut 2002: Die gesellschaftliche Risikovorsorge bedarf einer transdisziplinären Hochwasserforschung, in: Gaia 11, p. 247-254.
SCHOTT, Dieter (2003): Die Rolle von Katastrophen in der Stadtgeschichte. In: Informationen zur modernen Stadtgeschichte 1, p. 39-50.
SIEGENTHALER, Hansjörg (1993): Regelvertrauen, Prosperität und Krisen. Die Ungleichmässigkeit wirtschaftlicher und sozialer Entwicklung als Ergebnis individuellen Handelns und sozialen Lernens, Tübingen.
TORGAUER Kreis-Blatt, No. 6. Sonnabend, am 10. Februar 1838, p. 42-45.
TORGAUER Kreis-Blatt, No. 8. Sonnabend, am 24. Februar 1838, p. 57-59.
WEICHSELGARTNER, Jürgen (2003): Nach der Elbeflut 2002: Und danach? Nachtrag zur transdisziplinären Hochwasserforschung, in: Gaia 12, p. 245-248.